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Sporadic Cases of Meningococcal Meningitis Serogroup W-135 — Ethiopia, 2013

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Abstract: Meningococcal meningitis is a serious bacterial infection of the meninges often caused by *N.* meningitides. Epidemics occur in 8-12 year cycles, usually in the dry season, across the African meningitis belt. In February 2013, West Arsi zone reported a suspected meningitis outbreak to Regional Public Health Emergency Center. Investigation was done to confirm the etiology, identify risk factors, and establish control measures. A suspected case was defined as any person with sudden onset of fever (>38.5°C rectal or 38.0°C axillary) and one of the following signs: neck stiffness, flaccid neck, bulging fontanel, convulsion or other meningeal sign and confirmed case as identified N. *meningitidis* from the CSF of a suspected case by culture, PCR or agglutination test. From January 23, 2013 up to April 17, 2013, a case investigation was conducted to identify suspected patients and confirmed meningitis for patients cerebrospinal fluid collected. We also conducted case-control study. Descriptive statistics and odds ratios with 95% confidence intervals were calculated to compare risk factors among cases and controls. A total of 99 cases and 3 deaths were occurred from January 23- April 27, 2013. The median age was 12 years with a range from 3 months to 68 years. Majority (89.9%) of the cases were below 30 years of age and children under five years of age were the most affected (28%) and Attack Rate (AR=4.2/100000). Ten (59%) patients with N. *meningitidis* were confirmed as serotype "A", 6 (35.3%) patients were confirmed by latex agglutination test and PCR as serotype W135 and 1 (5.9%) patient was confirmed as mixed serotype. 24 confirmed and suspected Meningococcal *meningitis* patient cases and 96 community matched by sex, age and place of residence controls were included in the case control study. Recent travel to an area where patients with meningitis were reported (Odds Ratio (OR): 10.0, 95% Confidence Interval (CI): 3.7-27.3), attending in the occasion of gathering of population (OR: 7.7, 95% CI: 2.9-20.6) and a history of upper respiratory tract infection (OR: 7.2, 95% CI: 2.6-19.9) were risk factors. We verified sporadic cases of meningococcal meningitis in the areas. Incidence of disease was highest in children under five years of age. This was the first season that W135 was identified in Ethiopia. Further surveillance for W135 should be conducted in Ethiopia to guide vaccination policy.

Keywords: Meningococcal Meningitis, Sporadic Cases, W-135

1. Introduction

Meningococcal meningitis is an infection caused by Neisseria *meningitides* [1]. The meningococci infect the meninges, the thin lining that surrounds the brain and the spinal cord and the fluid around them [2]. High fever, severe headache, and stiff neck are common symptoms of the disease in anyone over the age of two years. The symptoms can develop over several hours, or they may take one or two days. Other symptoms include nausea, vomiting, discomfort looking into bright light, confusion, and sleepiness. In newborns and small infants, the symptoms may be difficult to detect [1, 2].

Neisseria *meningitidis* (N. *meningitidis*) can be classified into over 13 distinct serogroups on the basis of the antigenicity of the polysaccharide capsule. Five serogroups of N. *meningitidis* – A, B, C, W-135 and X – are found across the "meningitis belt" that stretches across Africa, from Senegal to Ethiopia. Most large meningitis epidemics are caused by serogroup 'A' meningococci [1].

The bacteria are carried in the throat, often with no symptoms, and are transmitted from person to person through droplets of respiratory or throat secretions as a result of prolonged, close contact (3). The average incubation period is 4 days, but can range between 2 and 10 days [3].

In this area sporadic infections occur in seasonal annual

cycles while large-scale epidemics occur at greater intervals with irregular patterns [2]. In the African meningitis belt, epidemics of serogroup 'A' meningococci occur in cycles every 8–12 years, and each epidemic wave follows a multiyear crescendo-decrescendo pattern [3]. Meningococcal disease remains an important cause of meningitis and sepsis worldwide [4–6].

Since the early 1970s, polysaccharide meningococcal vaccines have been used in industrialized countries and during outbreaks throughout the world [7]. Licensure of conjugate vaccines offers new scope for prevention of disease [8, 9].

Serogroup W-135 has emerged as a cause of outbreaks associated with the Hajj pilgrimage and as the cause of disease in the African meningitis belt, including a large epidemic in Burkina Faso (10). Significant prevention challenges still exist for Africa. The African meningitis belt extends from Ethiopia to Senegal and has cyclical epidemics occurring every 5–10 years, resulting in attack rates of 1000 cases per 100,000 persons [7]. Historically, Neisseria meningitidis serogroup A has been the most common serogroup to cause disease in this region [11]. An international outbreak of N. meningitidis serogroup W135 meningococcal disease among Hajj pilgrims in 2000 and 2001 highlighted the importance of this serogroup [12–16]. Cases of W135 disease were also identified in Burkina Faso in 2001 [17], during an epidemic in the same country in 2002 [18], and in other countries in the meningitis belt [19, 20]. In 2002, when an epidemic took hold in Burkina Faso, the strain affected more than 13,000 people and killed at least 1,500. In 2003, some 3,500 deaths were attributable to the pathogen [1, 2].

Ethiopia fall in the meningitis belt, but for many decades, there has been endemic meningococcal disease, with seasonal increases during the spring and summer months (March–October). The burden of disease occurs in a cyclical pattern at intervals of 8–10 years.

Third-generation cephalosporins are available in hospitals and clinics for empirical treatment of acute bacterial meningitis. Routine and large-scale uses of meningococcal vaccines are not standard in Ethiopia.

Risk factors for invasive disease and for outbreaks are not completely understood [1]. Combinations of conditions (environment, host and organism) are necessary for an epidemic to occur [2]. These include: immunological susceptibility of the population (perhaps due to loss of herd immunity to the prevalent strain), special climatic conditions (dry season, dust storm), low socioeconomic status and transmission of a virulent strain. Acute respiratory tract infections may also contribute to the development of meningococcal disease epidemics [1, 2].

On January 31, 2013 West Arsi Zone Health Department reported an outbreak of Meningococcal meningitis in the zone to Oromia Region Public Health Emergency Center. Outbreak investigation team was sent to the area in the first week of February 2013.

This outbreak was investigated to identify risk factors associated with meningococcal meningitis outbreak and undertake public health actions in Shalla, Shashemene town and Shashemene rural areas. Populations in these areas during the dry season, from December to June, are at high risk of outbreaks of this disease.

2. Methods

2.1. Laboratory Methods

To initiate appropriate preventive actions, early confirmation of diagnosis and the identification of the serogroup are critical. Laboratory tests performed on CSF samples to determine confirmed cases are gram stain and cell count, rapid latex agglutination test and culture and sero-grouping.

2.2. Descriptive Epidemiology

A suspected case of Meningococcal meningitis is any person with sudden onset of fever (>38.5°C rectal or >38.0°C axillary) and one of the following signs – neck stiffness, flaccid neck, bulging fontanel, convulsion or other meningeal signs.

A probable case is any suspected case with macroscopic aspect of its CSF turbid, purulent; or with microscopic test showing Gram negative diplococci; or with leukocytes count of > 10 cells/mm^3.

A confirmed case or probable case of Meningococcal meningitis in which isolation or identification of the causal pathogen N. *meningitidis* from the Cerebro Spinal Fluid (CSF) was undertaken by culture, PCR or agglutination test.

2.3. Analytic Epidemiology

Neighbors with no fever, neck stiffness, flaccid neck and bulging fontanel were selected as healthy controls and matched for age and sex to meningococcal meningitis cases identified by laboratory in between February 8-21, 2013.

3. Results

3.1. Laboratory

From January 23, 2013 up to April 17, 2013 a total of 79 (80%) cerebro spinal fluid (CSF) was collected and Gram stain was conducted on CSF samples. The collected samples were examined by Rapid Latex Agglutination Test (Pastorex). A total of 17 (17.2%) contained gram negative diplococcic suggestive of N. *meningitidis* with 21.5% positivity rate. Ten (58.8%) patients with N. *meningitidis* were confirmed as serotype "A", 6 (35.3%) patients were confirmed as serotype W135 and 1 (5.9%) patient was confirmed as mixed serotype. 1 sample (1%) was culture positive for *N. meningitidis* serotype A. For 19 patients (19%) CSF sample was not taken and for 4 cases (4%) result was not recorded in the laboratory.

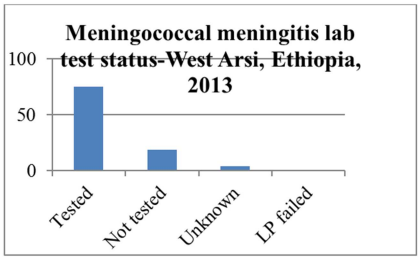

Figure 1. *Laboratory test status of suspected meningococcal meningitis patients-West Arsi, Oromia, Ethiopia, 2013.*

3.2. Descriptive Epidemiology

Shashemene Rural, Shalla and Shashemene town reported 78 suspected, 4 probable and 17 confirmed cases of meningococcal meningitis cases with highest Attack Rate (AR) in week 7 and 8 (3.64/100,000) and Incidence Rate (IR) of 16.4 per 100,000 from January 23,2013 to April 23, 2013. Three deaths with Case Fatality Rate (CFR) of 3.03% were seen during the period. The median age of patient cases was 12 years (range 2 months−68 years), and 54.5% were male. The common clinical features of the disease were fever in 98%, neck stiffness in 89%, flaccid neck in 73%, prostration in 53%, vomiting in 53%, confusion in 43%, chills in 42%, convulsion in 11%, shock in 7%, bulging fontanel in 5% and comma in 4% in suspected Meningococcal meningitis (Table 1).

Table 1. *Clinical features of meningococcal meningitis patients-West Arsi, Oromia, Ethiopia, 2013.*

Clinical symptom	Meningococcal meningitis patients having this symptom	Percent from total symptoms
Fever	97	98
Neck stiffness	88	89
Flaccid neck	72	73
Vomiting	52	53
Confusion	43	43
Chills	42	42
Vomiting	39	39
Convulsion	11	11
Shock	7	7
Bulging fontanel	5	5
Comma	4	4

Meningococcal meningitis cases occurred sporadically not clustered in the same area indicating nonoccurrence of N. *meningitidis* outbreak in three districts (Shalla, Shashemene Rural and Shashemene Town) as indicated in Figure 1.

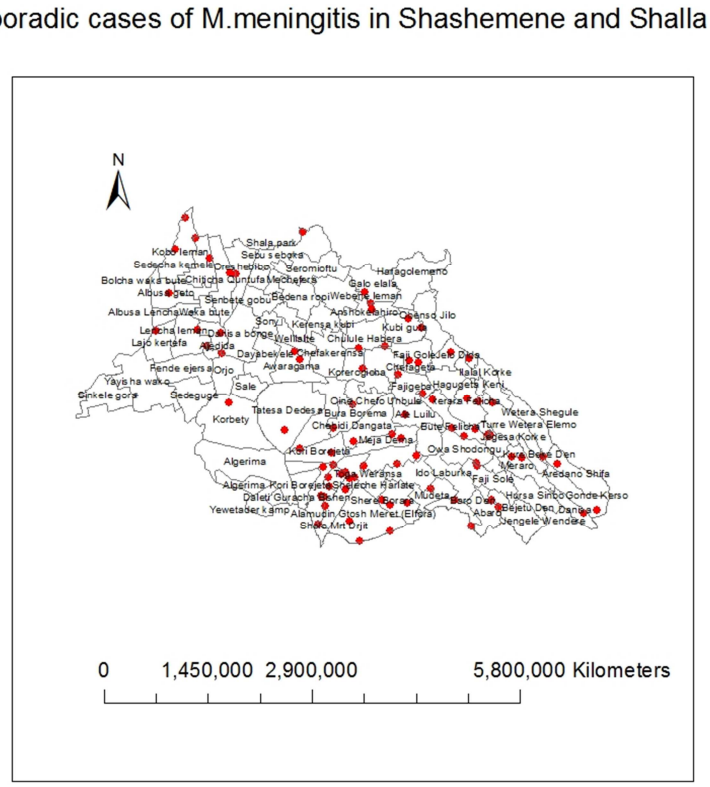

Figure 2. *Spatial distribution of meningococcal meningitis cases in Shala, Shashemene Rural and Shashemene Town-West Arsi, Oromia, Ethiopia, 2013.*

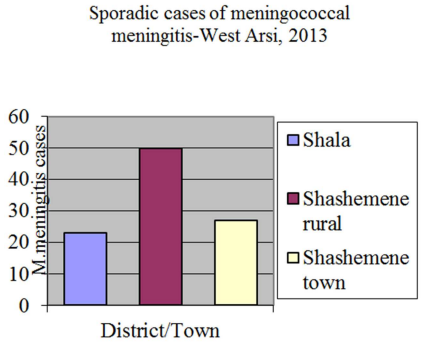

Figure 3. *Burden of meningococcal meningitis by woreda/town-West Arsi, Oromia, Ethiopia, 2013.*

Most of the Meningococcal meningitis sporadic cases were occurred in Shashemene Rural woreda. As indicated in Figure 2 49 (49.5%) were occurred in Shashemene Rural, 27 (27.3%) were occurred in Shashemene Town and 21 (23.2%) were occurred in Shalla woreda.

There was increased number of meningococcal meningitis cases in week 7 and 8 with AR of 3.64 during the period. This was especially in Shashemene rural and Shashemene town as indicated in Table 2.

Table 2. *Meningococcal meningitis cases by woreda/town-West Arsi, Oromia, Ethiopia, 2013.*

Week	Shalla		Shashemene Rural		Shashemene Town		Total	
	No of cases	AR	No of cases	AR	No of cases	AR	No of cases	AR
Week 4	1	0.57	0	0	1	0.60	2	0.33
Week 5	0	0.00	0	0	1	0.60	1	0.17
Week 6	4	2.27	1	0.38	0	0.00	5	0.83
Week 7	3	1.70	12	4.58	7	4.23	22	3.64
Week 8	4	2.27	13	4.97	5	3.02	22	3.64
Week 9	2	1.13	5	1.91	4	2.42	11	1.82
Week 10	4	2.27	6	2.29	4	2.42	14	2.32
Week 11	1	0.57	3	1.15	2	1.21	6	0.99
Week 12	2	1.13	2	0.76	0	0	4	0.66
Week 13	0	0	5	1.91	1	0.60	6	0.99
Week 14	1	0.57	1	0.38	2	1.21	4	0.66
Week 15	0	0	0	0	0	0	0	0
Week 16	1	0.57	1	0.38	0	0	0	0
Week 17	0	0	0	0	0	0	0	0

Children under five years of age were mostly affected (28.3%) as indicated in Figure 4. 89.9% of the cases were below 30 years of age.

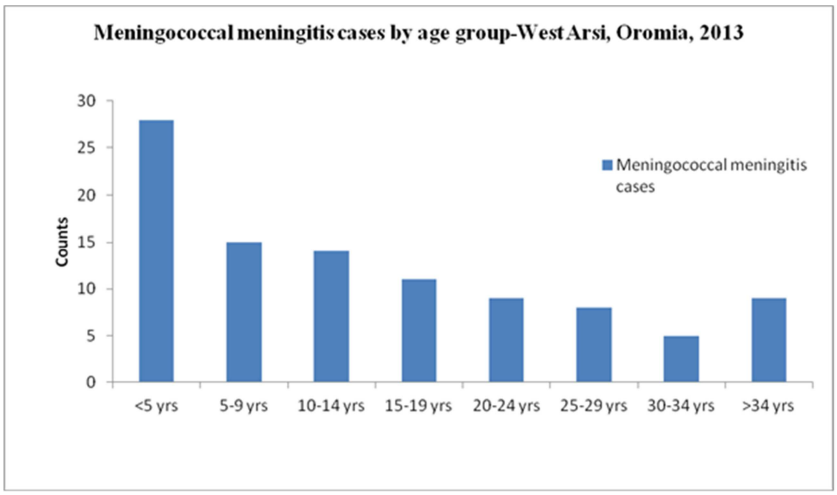

Figure 4. *Meningococcal meningitis cases by age group-West Arsi, Oromia, Ethiopia, 2013.*

Probable index case was from Shalla woreda, Albula Geto kebele. The date of onset of disease was on January 23, 2013 having epidemiological linkage with Sidama zone. He had died in Hawassa Referral Hospital while on treatment. Meningococcal meningitis cases was highly increased in week 7 from 5 cases in week 6 to 22 cases in week 7 and started declining from week 11.

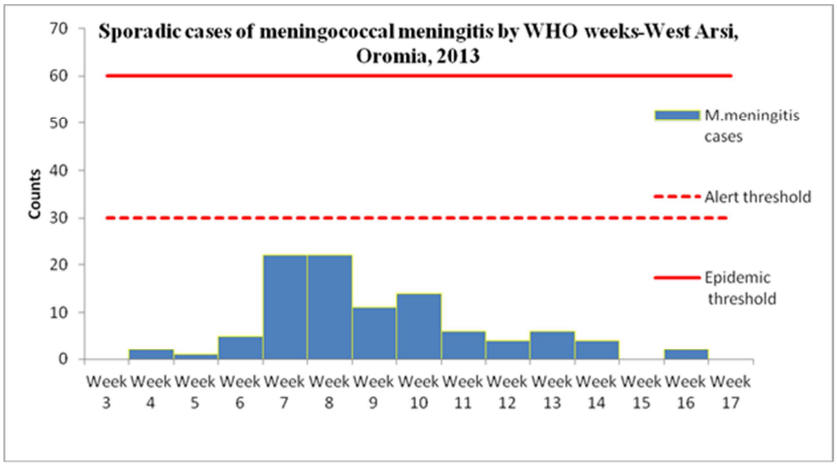

Figure 5. *Epi curve of sporadic cases of meningococcal meningitis-West Arsi, Oromia, Ethiopia, 2013.*

3.3. Analytical Epidemiology

We compared 24 meningococcal meningitis patient cases with 68 community matched controls by sex, age and place of residence. Descriptive statistics and odds ratios with 95% confidence intervals were calculated to compare risk factors among cases and controls". Analysis was performed using Epi Info version 7. A total of 64.7% of patient cases and 16.2% of controls selected from the community had history of recent travel to the area where meningitis was reported and attended a social gathering (wedding or funeral) during the time. About 53% of meningitis case patients and 20.6% community matched controls had a recent history of upper respiratory tract infection. Using case-control study recent travel to an areas where cases of N. *meningitidis* was reported (Odds Ratio (OR): 10.0, 95% confidence interval: 3.7-27.3), attending a social gathering (OR: 7.7, 95% confidence interval: 2.9-20.6) and a recent history of upper respiratory tract infection (OR: 7.2, 95% confidence interval: 2.6-19.9) were risk factors for meningococcal meningitis.

4. Public Health Action

Vaccination for meningitis is not routinely done in Ethiopia. To reduce the burden of the disease 62 at risk kebeles were identified from 86 kebeles found in Shalla, Shashemene Rural and Shashemene Town. A total of 317, 899 population were targeted for vaccination against M. meningitis. A tetravalent meningococcal polysaccharide vaccine (4vMenPV) was given to 282,391 (88.8%) population of 2-30 years of age.

5. Discussion and Recommendation

Serogroup 'A' Neisseria meningitidis caused the highest incidence of disease in Shalla, Shashemene Rural and Shashemene Town which is similar to few studies that have been undertaken in Africa and study conducted by D. Dalecha in Kembeta Zone, Southern Ethiopia in 2011. Incidence of disease was highest in younger children which opposes studies conducted in African Meningitis belt which says there were high incidencein older children and young adults.

Serogroup W-135 was emerged in the areas. Study conducted by David S. Stephens also indicated that Serogroup W-135 was emerged as a cause of outbreaks associated with the Hajj pilgrimage and as the cause of disease in the African meningitis belt, including a large epidemic in Burkina Faso since the mid-1990s.

6. Conclusions and Recommendations

I dentified sporadic cases of meningococcal meningitis that did not meet the definition for an outbreak in Shalla, Shashemene Rural and Shashemene Town. Extended dry season may have contributed to the outbreak. Serogroup A Neisseria *meningitidis* caused the highest incidence of disease in the area. Also Serogroup W-135 was identified in the areas. Incidence of disease was highest in older children and young adults.

Adults and children >2 years of age should receive 1 dose of the quadrivalent (A, C, Y, W135) vaccine, and children between 3 months and 2 years of age should be given 2 doses of the "A"vaccine with a 3-month interval between the 2 doses. Routine vaccination for N. *meningitidis* should be considered.

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